

**KAATZ, BINKLEY, JONES, & MORRIS ARCHITECTS, INC.**  
**ARCHITECTS – ENGINEERS – EDUCATIONAL PLANNERS**

William T. Morris, AIA    Larry D. Marvel, AIA    Gary C. Kromer, RA    Jason Morris, AIA

**ARCHITECTURE**

William T. Morris, AIA, *Chairman*  
Steve G. Morris  
Larry D. Marvel, AIA, CSI/CDT  
Gary C. Kromer, RA, CEFPI  
Jason Morris, AIA  
Nathan Dutch

**ENGINEERING**

Sandy Olandt, PE

**INTERIORS**

Kathy Richards, NCIDQ, CSI/CDT  
Jenni Cozart, NCIDQ

**EDUCATIONAL PLANNERS**

Debbie Morris

**ADMINISTRATION**

Penny Phillips

August 22, 2023

Dr. Scott Langford  
Director  
Sumner County Schools  
695 East Main Street  
Gallatin, TN 37066

RE: Structural Assessment Report  
Sumner County Football Stadium Bleachers

Dear Dr. Langford,

In compliance with your request, KBJM Architects, Inc. has completed a structural assessment of all eight High School football stadium bleachers within Sumner County. The attached report documents the results of the assessments.

This report includes the type of construction, results of the visual inspections, an engineering interpretation of the effects of these findings on structural integrity, and recommendations for the continued use of the stadium bleachers for each stadium.

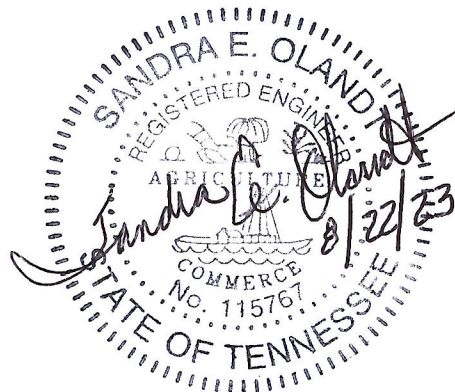
If you have any questions concerning this report, please feel free to contact us at your convenience. It is our pleasure to assist you on this project.

Respectfully submitted,

KBJM Architects, Inc.



Sandra E. Olandt, PE  
Sr. Structural Engineer



Structural Assessment Report  
Sumner County Football Stadium Bleachers

Prepared for:

Dr. Scott Langford, Director  
Sumner County Schools  
695 East Main Street  
Gallatin, TN 37066

Prepared By:

Sandra E. Olandt, PE  
Senior Structural Engineer  
Kaatz, Binkley, Jones & Morris Architects, Inc.  
1008 Charlie Daniels Parkway  
Mt. Juliet, TN 37122

August 22, 2023

## INTRODUCTION

As requested, Kaatz, Binkley, Jones and Morris Architects, Inc. (KBJM) performed a structural condition assessment of all eight Sumner County High School football stadium bleachers. The structural assessments were performed by Sandra Olandt, PE on August 16, 2023, and August 17, 2023.

The purpose of these assessments was to evaluate the structural condition of the bleachers and to establish the safety of the bleachers for continued use during the 2023 football season. The assessments were prompted after the unexpected collapse of the Visitor bleachers at Beech High School. Due to the limited time and urgent nature, these assessments were visual only and did not involve non-destructive testing and inspection methods. The scope of these assessments was primarily focused on the structural support systems as a general overview for safety. Not all areas of the bleachers were accessible, and the assessments did not include a comprehensive review of every member and all components such as handrails and walkways.

## SUMMARY OF RECOMMENDATIONS FOR FACILITIES VISITED

### Beech High School Stadium

Remove the Home side bleachers from service immediately.

### Gallatin High School Stadium

Continue use of all bleachers for the remainder of the 2023 football season. Provide minor repairs to the Home side bleachers as outlined in the detailed report as soon as possible. Evaluate the option of rust removal, repairs and painting versus replacement of the Home side bleachers prior to the 2024 football season. Inspect the new Visitor side bleachers annually in accordance with ICC 300 and the manufacturer's guidelines.

### Hendersonville High School Stadium

Remove the Visitor side bleachers from service immediately. Continue use of the Home side bleachers for the 2023 football season while monitoring the number of spectators in the stands to prevent exceeding the design capacity. Provide repairs as outlined in the detailed report as soon as possible. Inspect the Home side bleachers prior to the spring track season to assess the state of the masonry walls.

### Liberty Creek High School Stadium

Continue use of all bleachers for the remainder of the 2023 football season. Inspect the bleachers annually in accordance with ICC 300 and the manufacturer's guidelines.

### Portland High School Stadium

Remove the center sections of the Home side bleachers from service immediately. The galvanized steel bleachers which flank either side of the original Home side bleachers may continue to be used for the duration of the 2023 football season. Continue use of the Visitor side bleachers. Inspect the bleachers annually in accordance with ICC 300 and the manufacturer's guidelines.

### Station Camp High School Stadium

Continue use of all bleachers for the remainder of the 2023 football season. Inspect the bleachers annually in accordance with ICC 300 and the manufacturer's guidelines.

### Westmoreland High School Stadium

Continue use of all bleachers for the remainder of the 2023 football season. Inspect the bleachers annually in accordance with ICC 300 and the manufacturer's guidelines.

White House High School Stadium

Remove the far-right section of the Home side bleachers from use for the remainder of the 2023 season or until realignment of the displaced concrete planks can be achieved. Cordon off the area to prevent spectators from accessing the space. Remove the Visitor side bleachers from use immediately until repairs outlined in the detailed report can be made. Once the repairs have been completed, the Visitor side can be used for the 2023 football season. Inspect all bleachers prior to the start of the 2024 football season.

# Structural Assessment

## Beech High School Stadium Bleachers



## DESCRIPTION OF STRUCTURE

Both the Home and Visitor sides of Beech High School football stadium bleachers were constructed in 1981 (42 years old) using concrete masonry unit walls on concrete foundations which support inverted precast concrete c-shaped planks. The stadium levels are achieved by stepping the masonry walls and stacking the precast planks with an overlap to form tiers. The stadium seating and handrails are then mounted to the top of the precast panels. Guardrails surround the seating area and are mounted to the precast plank or the masonry walls. Egress steps are placed at intermediate locations along the length of the bleachers. The side and front exterior walls are covered in brick veneer with the back side of the structure open to the elements. On the Home side, a free-standing press box is located at the back of the structure.

## VISUAL ASSESSMENT

### Home Side:

On approach to the structure, the bleachers look well maintained and attractive. The guard rail is in good condition and appears to be relatively new. Efflorescence is present in the exterior brick veneer on the side walls, but no significant cracking exists. The intermediate back walls have been painted and there are signs of spalling masonry. Upon entering the underside of the bleachers, the supporting masonry walls were found to be in very poor condition. The masonry is saturated with a large amount of moss growing on the walls. Multiple cracks run vertically in the walls and portions of masonry block are missing. The face of the masonry is disintegrating in multiple locations. The masonry lintels above the openings between bays have lost most of the face shell of the masonry and are left with exposed grout in the bond beam. At one opening, even the grout has deteriorated to expose the lintel reinforcing which is badly rusted. Within the built-out interiors below the bleachers, the ceilings have collapsed due to severe water intrusion. The concrete planks appear to be in good condition as viewed from both above and below. However, the gaps between planks at the point of bearing have no joint sealant, allowing water to infiltrate the masonry wall below. Damage to the structure is water related, the foundations appear to be stable with no settlement cracking in the masonry.

### Visitor Side:

The Visitor side collapsed without warning the previous day. Equipment was on site to remove the debris. Upon inspection of a collapsed portion of masonry wall, it was determined that the cores of the masonry had been grouted, but the spacing is unknown. No vertical reinforcing was evident in the structure. Horizontal reinforcing was present but was extremely rusted and brittle, much of it having broken into pieces during the collapse. Many of the concrete planks were still in one piece.

## IMPACT ON STRUCTURAL INTEGRITY

The original design of the stadium does not provide any redundancies in the structural system. The interior masonry walls support planks on both sides which then systematically support the next plank above until reaching the top. Failure of one structural element can lead to a progressive catastrophic collapse. The long-term presence of water within the masonry is evident from the moss growth on the structure. Water infiltration is one of the most damaging problems for masonry construction, particularly when partnered with the freeze-thaw cycles in the climate of Tennessee. The expanding water during a freeze will cause multiple cracks to form and eventually lead to spalling and deterioration of the face shell as seen in this structure. In addition, the water rusts the steel reinforcing reducing or eliminating any

strength and continuity that it initially provided. As the masonry continues to deteriorate, the overall integrity of the system is lost, and collapse is imminent.

#### RECOMMENDATION

Based on the extremely poor condition of the masonry support walls, it is my professional opinion that the Home side bleachers are at the end of their life span and should no longer be used in their current condition. I recommend that either extensive repairs be made, including replacement of the load-bearing masonry walls, or the entire structure be demolished and replaced with a galvanized steel and aluminum structure. The information required to make a repair or replacement decision is beyond the scope of this report.

PHOTOS



Efflorescence on brick veneer.



Spalling masonry along rear wall.





Water infiltration, moss growth, cracking and loss of section in interior masonry wall.



Loss of masonry and grout with exposed reinforcing in masonry lintel.



Water infiltration to built-out area beneath bleachers.



Absence of joint sealant between concrete planks.

Structural Assessment  
Gallatin High School Stadium Bleachers



## DESCRIPTION OF STRUCTURE

The Home side of Gallatin High School football stadium bleachers is constructed using a braced column and beam configuration with unconventional materials. The stadium is estimated to be approximately 80 years old. The interior columns and the diagonal beams consist of segments of railroad rails which have been welded together to create members of the required length. Diagonal bracing has been provided in both orthogonal directions to provide structural stability to the system. The tall exterior walls are formed using steel columns with infill masonry between them. Custom brackets are made of steel angle to support the bench seats. The sides of the structure are clad in light gauge steel siding, but the top is open to the elements.

The Visitor side bleachers are a brand-new galvanized steel and aluminum structure on concrete sonotube foundations. They have recently been installed along with other stadium renovations.

## VISUAL ASSESSMENT

Home Side:

On approach to the structure, the bleachers look well maintained. The guard rail, seating and metal siding are in good condition. Upon entering the underside of the structure, the steel is rusted with peeling paint, but is generally in fair condition. The welds of the rails making up the interior columns have been coated with a thick tar-like substance, assumably to prevent corrosion, and cannot be seen. The diagonal bracing is in fair condition, but the welds have failed in a few of the smaller members. The welded angles and plate creating the seat brackets are in poor condition with more substantial rusting of the elements. The biggest area of concern is the exterior columns. Several have had flanges and/or webs cut, presumably to run pipe or conduit which is no longer in place. The columns which have infill masonry between them are in the worst condition. Water infiltration into the masonry has corroded the flange of the columns. In some locations, there is a loss of section beyond surface rust. The columns show little deterioration above the masonry wall, and the masonry wall itself is in fair condition.

Visitor Side:

The Visitor side is brand new construction and appears in excellent condition. However, one section of the bleachers was surrounded with yellow caution tape without explanation.

## IMPACT ON STRUCTURAL INTEGRITY

The original design of the Home side bleachers is of conventional construction technique with the use of unconventional materials. Although the steel is rusting and paint is flaking, it appears to be in fair condition with minimal loss of section in the major support members. The columns which do have a loss of section due to rusting at masonry walls are not significantly impacted in axial strength due to the presence of the masonry walls which reduce the unbraced length of the columns by providing restraint in both directions. These masonry walls should not be removed unless immediate repairs to the column flanges are made. The columns with penetrations through the web or flange are more concerning. Although they have obviously been there for some time without consequence, the rust on these areas is progressing more rapidly than on the uncut surfaces. It is beyond the scope of this assessment to determine the adequacy of the original design for imposed loads. As it has been serving the intended function for considerable years, the existing bleacher structure is thereby deemed acceptable. The purpose of this assessment is to determine if the current problems negatively affect the load carrying capacity of the structure.

## RECOMMENDATION

It is my professional opinion that the Home side bleachers are still capable of supporting the intended loads for the remainder of the 2023 football season. However, there are several repairs that need to be made as soon as possible to ensure the safety of the occupants. Since this assessment was expedited, the time frame did not allow identification of all specific locations where repairs are needed. Maintenance personnel can use visual observation to identify the members which fall into these categories:

- Repair and/or replace-in-kind diagonal bracing where welded connections to columns or beams have failed.
- Provide cover plates welded to columns where flanges have been notched. Cover plates should be A36 steel with a minimum thickness to match the column flange and should extend across the notch to sound steel on either side.
- Replace or repair brackets supporting the bench seats above as deemed necessary. Failure of these brackets will not cause a collapse of the bleacher system but could contribute to injury of spectators.

It is recommended that this bleacher system be replaced with a new galvanized steel system prior to the 2024 football season. If this is not a viable option for the school system, then the steel support system should be sand blasted to remove rust. The structure can then be re-assessed at that time and repairs provided as needed. Once any identified repairs have been completed, then the entire structure should be repainted with a coating approved for exterior conditions to prolong the life of the steel members.

As far as the Visitor side bleachers, it is recommended that a certificate of use be provided by the bleacher supplier/erector to document construction completion prior to use. Safety inspections should be conducted on an annual basis in accordance with International Code Council Standards for Bleacher, Folding and Telescoping Seating, and Grandstands (ICC-300) and the manufacturer's written guidelines. These inspections can be made by a qualified individual familiar with the requirements and should be documented.

PHOTOS



Example of interior framing with railroad rail columns and beams, and diagonal bracing.



Corrosion of column flanges in contact with masonry walls.



Example of notched column flange.



Example of rusted seat bracket.



New Visitor side galvanized steel bleachers on sonotube foundations.



Structural Assessment  
Hendersonville High School Stadium Bleachers



## DESCRIPTION OF STRUCTURE

Both the Home and Visitor sides of Hendersonville High School football stadium bleachers were constructed in 1976 (47 years old) using concrete masonry unit walls on concrete foundations which support inverted precast concrete c-shaped planks. The stadium levels are achieved by stepping the masonry walls and stacking the precast planks with an overlap to form tiers. The stadium seating and handrails are then mounted to the top of the precast panels. Guardrails surround the seating area and are mounted to the precast plank or the masonry walls. Egress steps are placed at intermediate locations along the length of the bleachers. The exterior side walls are covered in brick veneer while the back side of the structure is painted masonry or steel siding, and chain link fence where it is open for storage. On the Home side, an integrated press box is located at the back of the structure.

## VISUAL ASSESSMENT

### Home Side:

On approach to the structure, the bleachers look well maintained and attractive. The guard rail is in good condition and appears to be relatively new. The exterior brick veneer on the side walls is in good condition with no significant cracking. The intermediate back walls have been painted and are in good condition with only a few places with damaged masonry. Upon entering the underside of the bleachers, the supporting masonry walls were found to be in fair condition. Although the walls show some water saturation and moss growth, there is not significant cracking, and the surface face of the block is not as deteriorated as seen at Beech High School. The masonry lintels above the openings between bays are still intact. Within the built-out interiors below the bleachers, the insulation board ceilings and supporting steel members do not show signs of water infiltration. The concrete planks appear to be in fair condition as viewed from both above and below. Water staining is more evident indicating the planks may not have been coated with a concrete sealer. There is one plank on the left side section of bleachers that has been displaced by approximately 2", possibly when constructing the build-out below. The gaps between planks at the point of bearing have no joint sealant, allowing water to infiltrate the masonry wall below. Damage to the structure is water related, the foundations appear to be stable with no settlement cracking in the masonry.

### Visitor Side:

On approach to the structure, the bleachers look well maintained and attractive. The guard rail is in good condition and appears to be relatively new. The exterior brick veneer on the side walls is in good condition with no significant cracking. The back walls have been painted and are in fair condition with several areas of spalling masonry. Upon entering the underside of the bleachers, the supporting masonry walls were found to be in very poor condition. The walls show water saturation but no moss growth since these areas are entirely enclosed. There is significant loss of the surface face of the masonry with several areas suffering a complete loss of section leaving a hole through the wall. The concrete planks appear to be in fair condition as viewed from both above and below. Water staining is more evident indicating the planks may not have been coated with a concrete sealer. One bay has an interior support wall and repairs to a concrete plank indicating previous problems with the structure were repaired. The gaps between planks at the point of bearing have no joint sealant, allowing water to infiltrate the masonry wall below. Damage to the structure is water related, the foundations appear to be stable with no settlement cracking in the masonry.

## IMPACT ON STRUCTURAL INTEGRITY

The original design of the stadium does not provide any redundancies in the structural system. The interior masonry walls support planks on both sides which then systematically support the next plank above until reaching the top. Failure of one structural element can lead to a progressive catastrophic collapse. The long-term presence of water within the masonry is evident from the moss growth and the disintegrating masonry block. Water infiltration is one of the most damaging problems for masonry construction, particularly when partnered with the freeze-thaw cycles in the climate of Tennessee. The expanding water during a freeze will cause multiple cracks to form and eventually lead to spalling and deterioration of the face shell as seen in this structure. In addition, the water rusts the steel reinforcing reducing or eliminating any strength and continuity that it initially provided. As the masonry continues to deteriorate, the overall integrity of the system is lost, and collapse is imminent.

## RECOMMENDATION

Based on the extremely poor condition of the masonry support walls, it is my professional opinion that the Visitor side bleachers are at the end of their life span and should no longer be used in their current condition. It is my opinion that the Home side bleachers are nearing their functional life span but are still safe for use for the remainder of the 2023 football season. However, since appearances are not complete indicator of structural integrity, I recommend the follow provisions be in place for the remainder of the season:

- During use, the crowd size should be monitored to eliminate the possibility of exceeding the design capacity of the structure. Spectator capacity should be based at a minimum of 18” of seating per person or preferably 24” of seating per person.
- Before and after each use, members of the maintenance staff familiar with the current condition of the structure should perform a visual assessment of the masonry walls to monitor for changes – increased cracking, loss of block, etc. Changes should be reported to the Structural Engineer as soon as they are found.
- Before and after each use, members of the maintenance staff familiar with the current condition of the structure should perform a visual assessment of the plank which is out of alignment. Changes to the alignment of this plank, and any other planks, should be reported to the Structural Engineer as soon as they are found.
- Masonry walls should be treated to remove the moss growth and prevent future growth.

Prior to the start of the 2024 spring track season, the Home side bleachers should be visually assessed for further damage from winter freeze before allowing use of the structure. I recommend that a plan be put in place to either provide extensive repairs to the Home side, including replacement of the load-bearing masonry walls, or that the entire structure be demolished and replaced with a galvanized steel and aluminum structure. The repair or replacement should take place as soon as feasible. The information required to make a repair or replacement decision is beyond the scope of this report. Until this decision is made and implemented, the existing structure should be inspected before each football season and track season to determine suitability for use.

PHOTOS



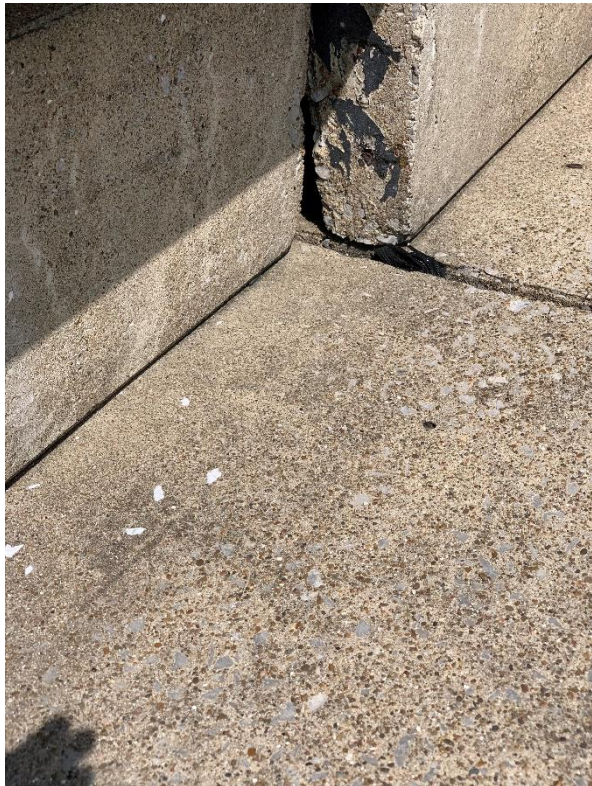
Back side of Home side bleachers.



Interior Home side masonry walls with water infiltration and moss growth.



Interior masonry built-out space below Home side bleachers without water infiltration.



Single displaced concrete plank on left side section of Home side bleachers.



Extensive loss of section in Visitor side masonry wall.



Previous repair to concrete plank and infill masonry wall providing intermediate support.

Structural Assessment  
Liberty Creek High School Stadium Bleachers



## DESCRIPTION OF STRUCTURE

The Home side lower level and Visitor side bleachers at Liberty Creek High School are galvanized steel and aluminum structures built into the side of a bermed hill. The Home side upper bleachers is a free standing galvanized steel and aluminum structure. The stadium was built in 2022 and is approximately one year old.

## VISUAL ASSESSMENT

Home and Visitor Sides:

The Liberty Creek High School football stadium is one year old and appears to be in excellent condition. The lower sections are built into the side of a bermed hill with minimal access to the underside. The surrounding hillside is planted with vegetation to prevent erosion, however, there does not appear to be a method to prevent side erosion of the hill to the areas under the bleachers. The upper section on the visitor side is free standing with easy access to the underside of the structure.

## IMPACT ON STRUCTURAL INTEGRITY

The stadium bleachers at Liberty Creek High School show no areas of deterioration or wear. They should be capable of supporting the original design capacity.

## RECOMMENDATION

It is my professional opinion that the bleachers at Liberty Creek High School are safe to use for the 2023 football season and well beyond. Safety inspections should be conducted on an annual basis in accordance with International Code Council Standards for Bleacher, Folding and Telescoping Seating, and Grandstands (ICC-300) and the manufacturer's written guidelines. These inspections can be made by a qualified individual familiar with the requirements and should be documented. During that time, the adjacent hills should be monitored for erosion that would negatively impact the functional use of the bleachers.



PHOTOS



View of Visitor side bleachers.



Side view of vegetation on hill adjacent to Home side lower bleachers.

# Structural Assessment

## Portland High School Stadium Bleachers



## DESCRIPTION OF STRUCTURE

The central section of the Home side bleachers of Portland High School football stadium was built in 1975 (48 years old.) They were constructed using concrete masonry unit walls on concrete foundations which support inverted precast concrete c-shaped planks. The stadium levels are achieved by stepping the masonry walls and stacking the precast planks with an overlap to form tiers. The stadium seating and handrails are then mounted to the top of the precast panels. Guardrails surround the seating area and are mounted to the precast plank or the masonry walls. Egress steps are placed at intermediate locations along the length of the bleachers. A free-standing press box on a steel frame is located at the back of the structure. Sometime later, a section of galvanized steel bleachers was added to each side of the original seating to increase the home side crowd capacity. Several 4-row portable bleachers sit off to the side as well.

The Visitor side bleachers consist of a newer galvanized steel and aluminum structure built into the side of the hill. A short retaining wall runs along the front face of the bleachers. A smaller free-standing press box sits behind the bleachers.

## VISUAL ASSESSMENT

### Home Side:

On approach to the structure, the outer bleachers look well maintained but the original sections are showing signs of age. Upon entering the underside of the original bleachers, the supporting masonry walls were originally found to be in good condition. It was then determined that new exterior side walls had been added to the interior, but the old side walls were left in place. Water saturation in the original walls was seeping through to the newer walls. The interior wall sections of the outer two bays had not been replaced and were in very poor condition. There was a significant loss of face section of the masonry blocks leaving holes through to the other side. The concrete plank above also showed significant signs of deterioration with exposed reinforcing on the underside of the plank in both the stem and the web areas. The front retaining wall was bowed and cracked along the length of the top bond beam indicating that the planks were pushing the wall forward. The gaps between planks at the point of bearing were previously filled with joint sealant, but much of it has deteriorated beyond usefulness allowing water to infiltrate the masonry wall below.

The newer sections flanking the original bleachers are in good condition. The steel structure supporting the press box is also in good condition except for some rusting at the exposed connections. The portable bleachers appeared in good condition but were beyond the scope of this assessment.

### Visitor Side:

Most of the underside of the Visitor side bleachers is inaccessible. Viewed from the side and back of the bleachers and also from above, the structure appears to be in good condition. However, the short retaining wall along the walkway to the concession stand is starting to fail. There are significant cracks in the masonry and the face shell of the blocks is spalling in numerous locations.

## IMPACT ON STRUCTURAL INTEGRITY

The original design of the Home side stadium does not provide any redundancies in the structural system. The interior masonry walls support planks on both sides which then systematically support the next plank above until reaching the top. Failure of one structural element can lead to a progressive catastrophic collapse. Long term water infiltration in the block is evident and is one of the most damaging problems

for masonry construction, particularly when partnered with the freeze-thaw cycles in the climate of Tennessee. The expanding water during a freeze will cause multiple cracks to form and eventually lead to spalling and deterioration of the face shell as seen in this structure. In addition, the water rusts any steel reinforcing that might be present, reducing or eliminating any strength and continuity that it initially provided. As the masonry continues to deteriorate, the overall integrity of the system is lost, and collapse is imminent.

### RECOMMENDATION

Based on the extremely poor condition of the interior masonry support walls, it is my professional opinion that the original section of the Home side bleachers are at the end of their life span and should no longer be used in their current condition. I recommend that either extensive repairs be made, including replacement of all original load-bearing masonry walls, or entire structure be demolished and replaced with a galvanized steel and aluminum structure. The information required to make a repair or replacement decision is beyond the scope of this report.

The two newer sections of bleachers flanking the original sections on the Home side, as well as the Visitor side bleachers can continue to be used at this time. Safety inspections should be conducted on these bleachers on an annual basis in accordance with International Code Council Standards for Bleacher, Folding and Telescoping Seating, and Grandstands (ICC-300) and the manufacturer's written guidelines. These inspections can be made by a qualified individual familiar with the requirements and should be documented.

The retaining wall on the Visitor side should continue to be monitored. As deterioration and deformation increase, this wall should be replaced.

PHOTOS



Home side masonry wall with extensive loss of section.



Underside of concrete plank with deterioration of the concrete and exposed steel reinforcing.



Rusting steel in the column support of the Home side press box.



Cracking along the length of the top of the skirt wall along the front of the Home side bleachers.



Side view of Visitor side galvanized steel bleachers built into the hill.



View of back side of Visitor side bleachers built into the hill.



Deterioration of retaining wall along the Visitor side path to concessions.



# Structural Assessment

## Station Camp High School Stadium Bleachers



## DESCRIPTION OF STRUCTURE

The football stadium bleachers at Station Camp High School were constructed in 2002 (21 years old) using a galvanized steel and aluminum system on sonotube foundations. The Home side structure has a press box built integral with the bleacher framing. Chain link fencing is used as a guardrail surrounding the seating area with steel handrails separating aisles. The underside is also surrounded with tall chain link fencing to provide secure equipment storage beneath the bleachers.

## VISUAL ASSESSMENT

Home and Visitor Sides:

The Station Camp High School football stadium bleachers are approximately 21 years old and appear to be in very good condition. There are minimal areas of minor surface rust and no deterioration or damage visible to the structure. The only area of potential concern is the presence of dead vines along the lower chain link fence on the Home side. Vegetation, especially intrusive vines, can be very damaging to a structure and should be kept away from all bleachers.

## IMPACT ON STRUCTURAL INTEGRITY

The stadium bleachers at Station Camp High School show no significant areas of deterioration or wear. They should be able to maintain the original design capacity.

## RECOMMENDATION

It is my professional opinion that the bleachers at Station Camp High School are safe to use for the 2023 football season and well beyond. Safety inspections should be conducted on an annual basis in accordance with International Code Council Standards for Bleacher, Folding and Telescoping Seating, and Grandstands (ICC-300) and the manufacturer's written guidelines. These inspections can be made by a qualified individual familiar with the requirements and should be documented. Grounds maintenance personnel should also keep all intrusive vegetation away from the structure.

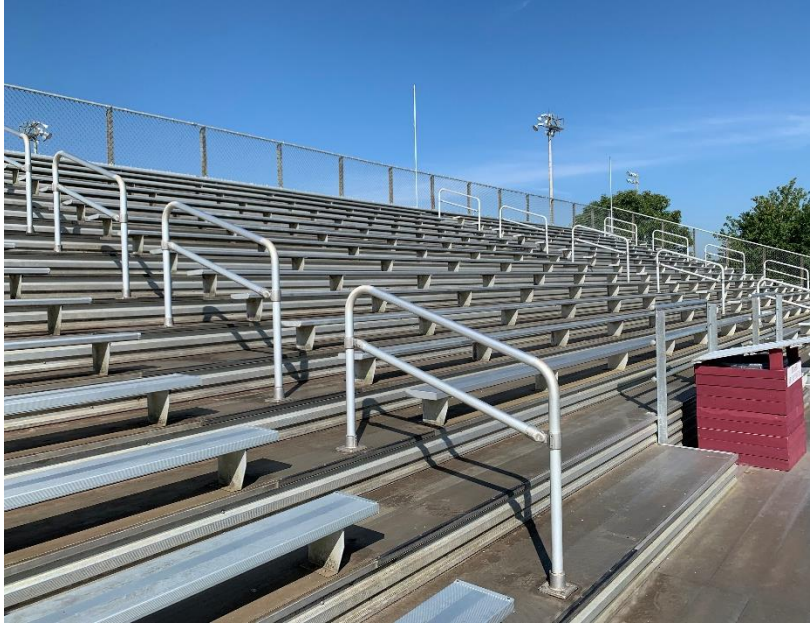
PHOTOS



Back side of Home side bleachers.



Evidence of invasive vegetation previously growing near the bleachers.



Front view of Visitor bleachers.



View of back side of Visitor bleachers.

Structural Assessment  
Westmoreland High School Stadium Bleachers



## DESCRIPTION OF STRUCTURE

The football stadium bleachers at Westmoreland High School were constructed in 1999 (24 years old) using a galvanized steel framing system on concrete foundations. Both the Home side and Visitor side bleachers have a press box built integral with the bleacher framing. Chain link fencing with intermediate horizontal rails is used as a guardrail surrounding the seating area. A non-load bearing masonry wall spans along the front of the Home bleachers.

## VISUAL ASSESSMENT

Home and Visitor Sides:

The Westmoreland High School football stadium bleachers are approximately 24 years old and appear to be in good condition. There are minimal areas of surface rust and no deterioration or damage visible to the structure. Many of the bolts used to make the structural connections appear to have been replaced since the structure was originally erected. What appears to be the original bolts are not galvanized and are rusting. In addition, the column base plates are not visible having been covered with concrete and/or topsoil. The area exposed at ground level and above appears to be in good condition. Further observations include a section of concrete walkway into the Home side bleachers is losing soil beneath the slab. Also, the floor of the Visitor side press box appears to have water damage.

## IMPACT ON STRUCTURAL INTEGRITY

The stadium bleachers at Westmoreland High School show no significant areas of deterioration or wear. They should be capable of supporting the original design capacity.

## RECOMMENDATION

It is my professional opinion that the bleachers at Westmoreland High School are safe to use for the 2023 football season and well beyond. Safety inspections should be conducted on an annual basis in accordance with International Code Council Standards for Bleacher, Folding and Telescoping Seating, and Grandstands (ICC-300) and the manufacturer's written guidelines. These inspections can be made by a qualified individual familiar with the requirements and should be documented. In addition, during annual maintenance of the bleachers, any rusted bolts should be replaced with galvanized steel bolts of the same type and diameter as removed and tightened to a snug tight condition. Where possible, I recommend uncovering column baseplates for inspection and to avoid possible corrosion of the anchor bolts. Surface drainage should be provided to eliminate any possibility of standing water surrounding the column baseplates.

The bearing surface under the concrete walkway should be corrected to prevent cracking and create a tripping hazard. The Visitor side press box was inaccessible and outside the scope of this assessment. However, inspection of the press box to determine the cause of the water damage should be investigated and repaired if not already done.

PHOTOS



Back side of Home side bleachers with buried base plates.



Example of rusted bolts needing replacement.



Undermining of concrete walkway at center entrance to Home side bleachers.



Water damage to the floor of the Visitor side press box.



Structural Assessment  
White House High School Stadium Bleachers



## DESCRIPTION OF STRUCTURE

The football stadium for White House High School was constructed in 1976 (47 years old.) The Home side bleachers were constructed using short concrete and masonry walls on concrete foundations along the slope of the hill adjacent to the field. These walls support inverted precast concrete c-shaped planks. The stadium levels are achieved by stepping the masonry walls and stacking the precast planks with an overlap to form tiers. The stadium seating is then mounted to the top of the precast panels. Guardrails surround the seating area are mounted to the precast plank along the top or bolted to the side walls. Egress steps are placed at intermediate locations along the length of the bleachers. A masonry retaining wall spans along the front of the bleachers. A free-standing press box is located at the back of the bleacher structure.

The Visitor side bleachers were constructed using full height concrete masonry unit walls on concrete foundations which support inverted precast concrete c-shaped planks in a similar configuration of overlapping planks, with stadium seating and handrails mounted to the top of the precast panels. Guardrails surround the seating area and are mounted to the precast plank or the masonry walls. Chain link fencing has been added to the steel handrails to increase fall protection. Egress steps are placed at the ends of the bleachers. A smaller press box is located behind the center section of the bleachers on masonry walls that enclose the back side. This area was inaccessible.

## VISUAL ASSESSMENT

### Home Side:

On approach to the Home side structure, the bleachers are showing signs of age. The underside of the bleachers is not accessible, but the areas that are accessible show signs of deterioration and deformation. There are several planks with spalling concrete and exposed reinforcing. The guardrail is not consistent with today's standards for child safety and fall protection. Joint sealant is present between the sections of concrete plank but is failing and no longer protects the structure below from water intrusion. Since the back side is not accessible, it is impossible to verify water damage, but it is probable in the support structure below. On the far-right section of the bleachers there are approximately 6 sections of inverted plank that have been displaced forward by several inches. The lower walking surface at the base of this section is also displaced.

### Visitor Side:

The initial view of the Visitor side bleachers revealed an exterior side wall in very poor condition with holes through the masonry and what appeared to be unsupported concrete planks. Entering the underside of the structure, it was determined that the outer wall was a veneer supporting only the guardrail. The masonry walls supporting the concrete planks were in fair condition overall with some isolated areas of concern. Water intrusion was evident along with moss growth but was not as widespread as in other stadiums previously viewed. Cracks in the masonry were present but were also not widespread, and the face of the masonry was still solid. However, there were several places where the planks were unsupported, and the ends exposed to weather due to missing masonry. The egress stairs were also in poor condition with displaced steps and insufficient foundation support. The non-load bearing masonry skirt wall along the front of the bleachers was damaged at the intersection with the load bearing wall, indicating movement of the structure. The interior bay of the bleachers was not accessible.

## IMPACT ON STRUCTURAL INTEGRITY

The original design of both the Home and Visitor sides of the stadium does not provide any redundancies in the structural system. The interior masonry walls support planks on both sides which then systematically support the next plank above until reaching the top. Failure of one structural element can lead to a progressive catastrophic collapse. Long term water infiltration in the block is evident and is one of the most damaging problems for masonry construction, particularly when partnered with the freeze-thaw cycles in the climate of Tennessee. The expanding water during a freeze will cause multiple cracks to form and eventually lead to spalling and deterioration of the face shell of the masonry as seen in this structure. In addition, the water rusts any steel reinforcing that may be present, reducing or eliminating any strength and continuity that it initially provided. As the masonry continues to deteriorate, the overall integrity of the system is lost, and collapse is imminent.

The Home side bleachers have taken the original design concept and built the support walls into the side of the hill. Visual inspection of the interior support walls is not possible, but the forward movement of the planks and walkway would indicate that the soil behind the structure is no longer stable. There may be significant water build-up behind the wall and/or the support walls are failing.

## RECOMMENDATION

Based on the overall poor condition of the Home side bleachers, it is my professional opinion that they are nearing the end of their life span. However, since the concrete planks are supported so close to the soil below, I do not believe that failure of the system would be catastrophic without warning as movement of the planks would be stopped by the soil below. I recommend that the Home side bleachers may continue to be used for the 2023 football season with the entire far-right side section of bleachers which already has displaced planks cordoned off to prevent spectator access. The bleachers should be visually inspected by maintenance personnel prior to each game to determine if any additional movement in the planks has occurred. If new movement of the planks is observed, I recommend discontinuing use of the bleachers for the remainder of the season.

The Visitor side bleachers are in fair condition with some isolated areas requiring immediate repair. It is my professional opinion that the Visitor side should not be used until the following repairs can be made.

- Gain access to the underside of the middle bay of the structure. If interior masonry walls are in similar condition to that observed in the outer bays, proceed with repairs. If these walls are in poor condition, contact the Structural Engineer before proceeding with work.
- Replace missing pieces of masonry to provide full support under the stems of the precast planks. Bearing pads are recommended to be placed between the planks and the infill masonry.
- Infill masonry under the plank webs at the end walls to reduce water infiltration to the structure.
- Seal gaps where water infiltration can occur at the top of masonry walls with backer rod and joint sealant.
- Where guardrail is supported by exterior crumbling masonry, reattach guardrail to solid substructure.
- Reposition riser blocks at egress stairs and repair masonry as needed.
- Repair masonry along the front skirt wall.
- Repair cracked masonry in the rear corner by injection grouting the vertical cells in this area and patching the exterior face shell.
- Treat the masonry walls to prevent moss growth.

Once the 2023 football season is complete, I recommend removing the planks on the far-right end of the Home side in order to assess the structure below. At this time, further evaluations can be completed, and a path forward developed to either repair or replace the bleachers. If repairs are successfully completed to the Visitor side, continue to perform annual inspections – preferably in the spring after winter freezes have stopped. With proper maintenance, this side may continue to provide service for several more years.

PHOTOS



Side view of Home side bleachers.



Example of deterioration in concrete plank with exposed reinforcing.



Far-right section of Home side bleachers with plank displacement.



Visitors side bleachers with crumbling side wall supporting guardrail.



Example of concrete plank requiring masonry support on Visitor side bleachers.



Example of missing block between stems of concrete planks to reduce water infiltration.



Egress steps requiring repair to realign the riser.



Location for repair front skirt wall at intersection of masonry support wall.





Crack in Visitor side rear wall requiring repair.